UNIVERSITI SAINS MALAYSIA

First Semester Examination
2012/2013 Academic Session

January 2013

EEE 208 – CIRCUIT THEORY II
[TEORI LITAR II]

Duration : 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of TWELVE (12) pages printed material and SIX (6) pages of Appendices before you begin the examination.
[Sila pastikan bahawa kertas peperiksaan ini mengandungi DUA BELAS (12) mukasurat bercetak beserta Lampiran ENAM (6) muka surat bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer **FIVE** (5) questions. Answer **TWO** (2) questions in Section A and **TWO** (2) questions from Section B and **ONE** (1) question from any section.
*[**Arahan:** Jawab **LIMA** (5) soalan. Jawab **DUA** (2) soalan dalam Bahagian A dan **DUA** (2) soalan dalam Bahagian B dan **SATU** (1) soalan daripada mana-mana Bahagian.]*

Use separate answer booklets for **Section A** and **Section B**.
*[Gunakan dua buku jawapan yang berasingan bagi **Bahagian A** dan **Bahagian B**.]*

In the event of any discrepancies, the English version shall be used.
[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.]

BAHAGIAN A

PART A

1. (a) Rajah 1(a) adalah litar yang menghasilkan keluaran saling antara dua pengaruh yang sesiri. Menggunakan pengetahuan asas sifat-sifat kearuhan saling dan kaedah analisis rangkaian,

Figure 1(a) is a circuit that produces the mutual inductance between two inductors in series. Using the basic knowledge of mutual inductance characteristics and network analysis method,

(i) Tentukan nilai arus, I

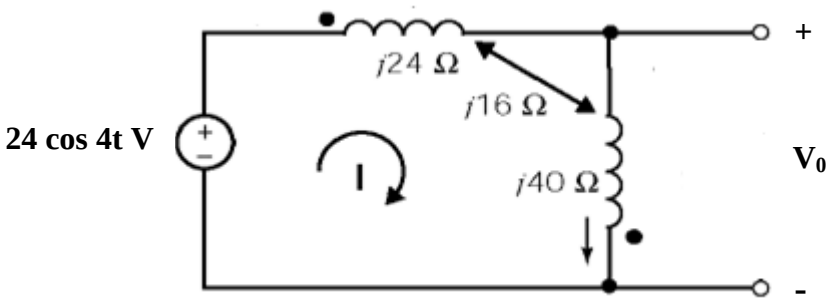
Determine the value of current, I

(20 markah/*marks*)

(ii) Dari nilai arus I, kira nilai voltan v_0 (t) daripada V_0

From the current value I, compute the value of v_o (t) from V_o

(20 markah/*marks*)



Rajah 1(a)

Figure 1(a)

(b) Satu litar pengubah unggul seperti dalam Rajah 1(b) mempunyai satu nisbah pusingan 1:5 di antara primer dan sekunder. Dari litar dan nilai nisbah pusingan yang diberi:

A circuit of an ideal transformer as in Figure 1(b) has a turn ratio 1 : 5 between primary and secondary. From the circuit and the given turn ratio value:

(i) Kira nilai galangan masukan, Z
Calculate the value of input impedance, Z

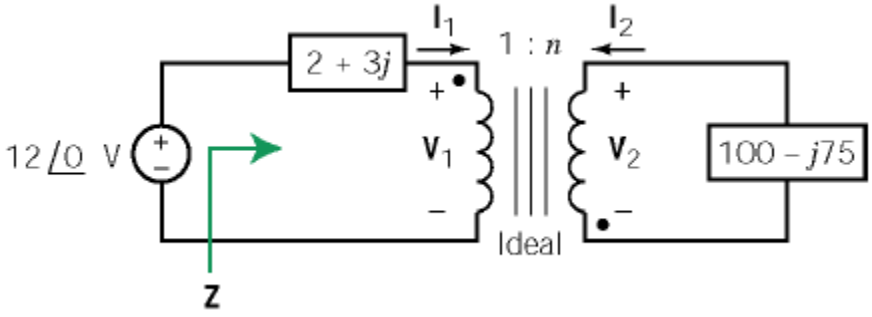
(15 markah/*marks*)

(ii) Kira nilai arus I_1 dan I_2
Calculate the value of current I_1 and I_2

(25 markah/*marks*)

(iii) Kira nilai voltan V_1 dan V_2
Calculate the value of voltage V_1 and V_2

(20 markah/*marks*)



Rajah 1(b)
Figure 1(b)

2.. (a) Dapatkan Jelmaan Laplace F(s) untuk i, ii dan iii (Rajah 2(a))
Find the Laplace Transform F(s) for i,ii and iii (Figure 2(a))

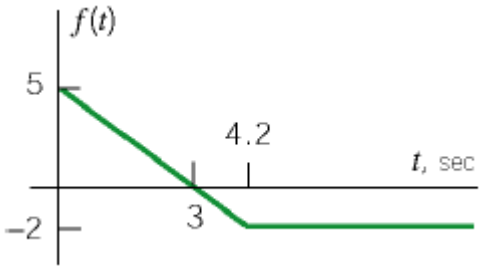
(i) $e^{-2t} + \sin t$

(10 markah/*marks*)

(ii) $\sin(t-2)\,u(t-2)$

(10 markah/*marks*)

(iii)

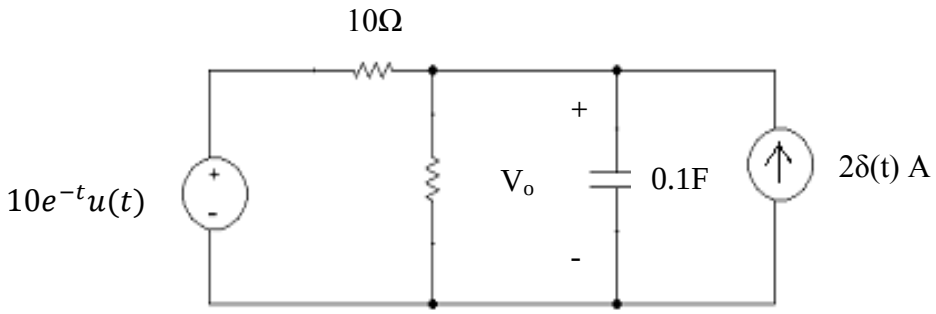


Rajah 2(a)
Figure 2(a)

(10 markah/*marks*)

(b) Rajah 2(b) mengandungi sumber voltan dan arus yang tidak bersandar setiapnya. Menggunakan kaedah penjelmaan litar setara (domain-t kepada domain-s) dan kaedah analisis rangkaian, tentukan v(t) apabila v(0) = 5 V

Figure 2(b) comprises voltage and current source which independent each other. Using circuit equivalent transformation method (t-domain to s-domain) and network analysis method, determine v(t) when v(0) = 5V.



Rajah 2(b)

Figure 2(b)

(25 markah/*marks*)

(c) Persamaan Hukum Voltan Kirchoff untuk satu litar diberi seperti berikut:

The Kirchoff Voltage Law (KVL) equation for a circuit is given as follows:

$$50i + 0.001\frac{di}{dt} + v = 2e^{-2\times10^4 t}$$

di mana v adalah voltan yang merentasi kapasitor. Hubungan antara arus dan voltan kapasitor dalam litar adalah

where v is the voltage across the capacitor. The relationship between capacitor current and voltage in the circuit is

$$i = (2.5 \times 10^{-6})\frac{dv}{dt}$$

Menggunakan maklumat yang diberi:
Using the given information:

(i) Lukis litar yang mengandungi kesemua komponen dan nilainya
Draw the circuit that includes all the components and its value.

(15 markah/*marks*)

(ii) Kirakan i(t) apabila i(0) = 1 A dan v(0) = 8V.

Calculate i(t) when i(0) = 1A and v(0)=8V.

(30 markah/*marks*)

3. (a) Sumber voltan v_g memacu litar ditunjukkan dalam Rajah 3(a). Isyarat sambutan adalah voltan merentasi kapasitor V_o,

The voltage source v_g drives the circuit shown in Figure 3(a). The response signal is the voltage across the capacitor, V_o.

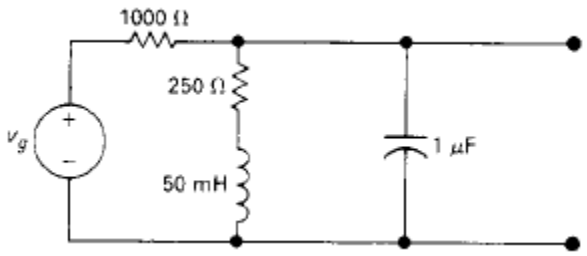
(i) Kira penyataan berangka untuk fungsi pindah
Calculate the numerical expression for the transfer function

(20 markah/*marks*)

(ii) Kira nilai-nilai berangka untuk kutub dan sifar untuk fungsi pindah

Calculate the numerical values for the poles and zeros of the transfer function.

(20 markah/*marks*)



Rajah 3(a)

Figure 3(a)

(b) Penyataan berangka untuk fungsi pindah bagi satu litar dinyatakan sebagai
The numerical expression of transfer function for a circuit given by

$$H(s) = \frac{10^4(s+1)}{(s+10)(s+100)}$$

Daripada fungsi pindah ini, permudahkannya kepada bentuk kutub dan sifar, kemudian

From this transfer function, simplify it to zeros and poles form, then

(i) Lakarkan plot Bode amplitud (gunakan graf semi-log A)
Draw a Bode amplitude plot (use the semi-log graph A).

(30 markah/*marks*)

(ii) Lakarkan plot Bode fasa (gunakan graf semi-log B)
Draw a Bode phase plot (use the semi-log graph B).

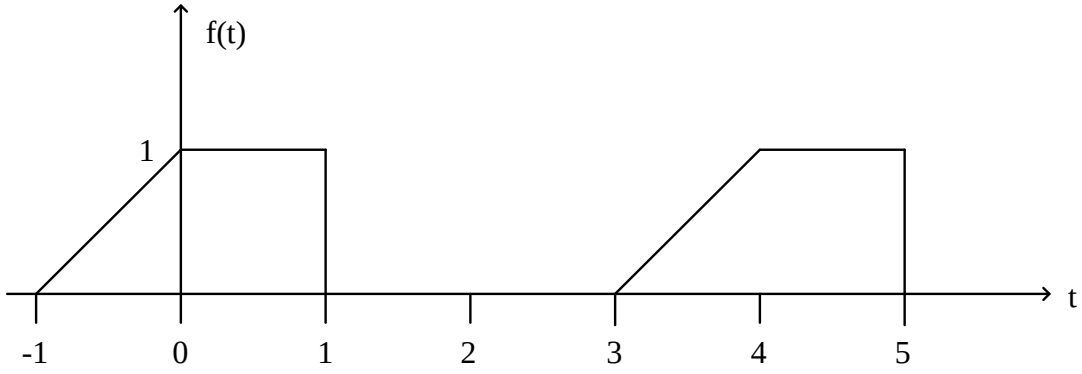
(30 markah/*marks*)

BAHAGIAN B

PART B

4. (a) Sebuah jenerator isyarat menghasilkan keluaran sebagaimana ditunjukkan di Rajah 4(a). Dapatkan ungkapan siri eksponen untuk isyarat tersebut.

A signal generator produces an output with the signal shown in Figure 4(a). Obtain the enponential series representation of the signal.



Rajah 4(a)

Figure 4(a)

(60 markah/*marks*)

(b) Amplitud dan fasa ungkapan Fourier disimpulkan sebagai

The amplitude and phase Fourier representation is given by

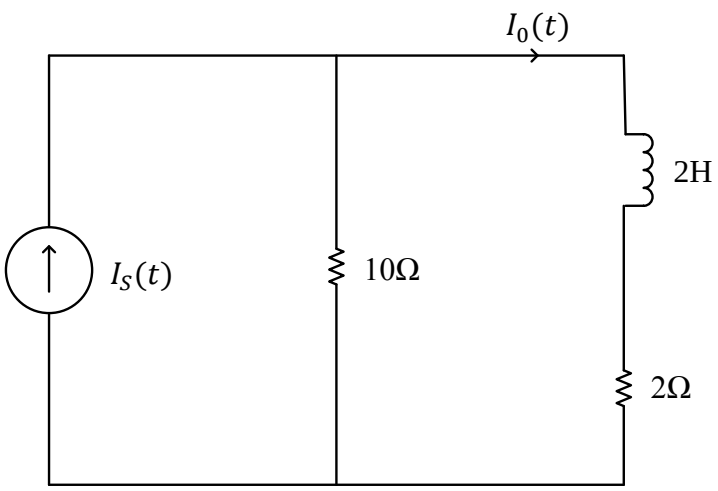
$$v(t) = 2 + \sum_{n-1}^{\infty} \frac{10}{n^3+1} \cos(2nt + \frac{n\pi}{4})$$

Tentukan pekali Fourier, $a_{0,}a_n$ dan b_n daripada $v(t)$.

Determine the Fourier Coefficient, $a_{0,}a_n$ *and* b_n *from this equation*.

(40 markah/*marks*)

5.



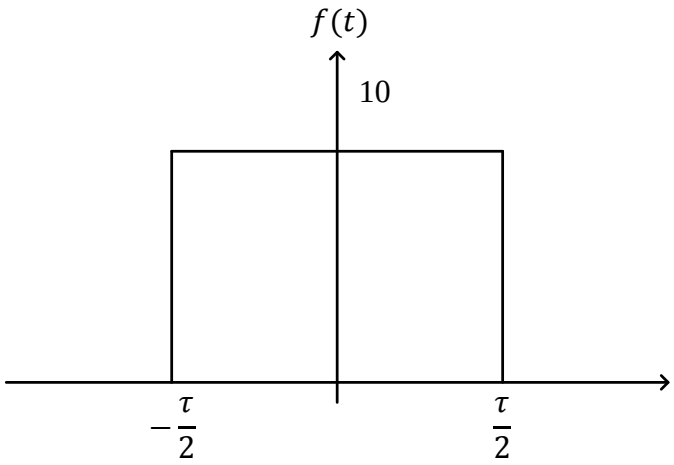
Rajah 5(a)

Figure 5(a)

(a) Litar dalam Rajah 5(a) mempunyai komponen selari dan disambungkan ke sumber arus, $I_s(t)$. Sumber tersebut menghasilkan isyarat $I_s(t) = 5\cos 4t\ A$. Dengan menggunakan kaedah Jelmaan Fourier, cari $I_0(t)$.

The circuit in Figure 5(a) contains parallel components and are connected to a current source, $I_s(t)$. The source produces a signal with $I_s(t) = 5\cos 4t\ A$.Using the Fourier Transform method, find $I_0(t)$.

(60 markah/*marks*)



Rajah 5(b)

Figure 5(b)

(b) Dedenyut tunggal di Rajah 5(b) menghasilkan Jelmaan Fourier

A single pulse in Figure 5(b) has a Fourier Transform at

$$F(\omega) = 10\tau \frac{\sin \frac{\omega\tau}{2}}{\frac{\omega\tau}{2}}$$

Apabila

when

$$\tau = 2, \qquad F(w) = 20\ sinc\ \omega$$

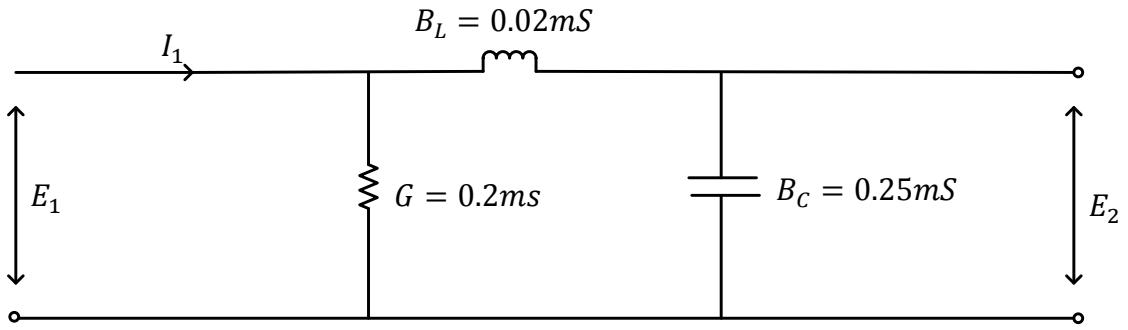
Lakarkan dan label spektrum amplitud dedenyut tersebut dengan jelas dan terangkan perbezaan dalam spektrum amplitud jika dedenyut tersebut adalah berkala.

Sketch and label clearly the amplitude spectrum of the pulse and explain the differences in the amplitude spectra if the pulse is periodic instead.

(40 markah/*marks*)

6. (a) Satu rangkaian-π telah dibina dan merupakan sebahagian daripada sebuah sistem. Hitung parameter-y untuk rangkaian-π di Rajah 6(a).

A π-network is constructed and is a part of a system. Determine the admittance parameters of the π-network in Figure 6(a).



Rajah 6(a)

Figure 6(a)

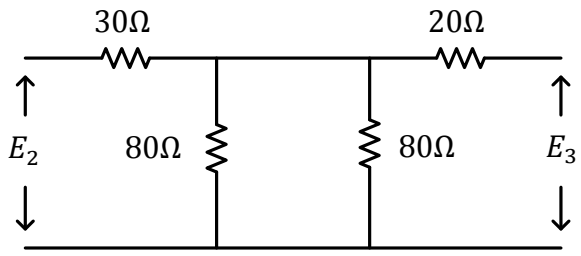
Nota :

Note :

$$y_1 = G$$
$$y_2 = -B_L$$
$$y_3 = -B_L$$

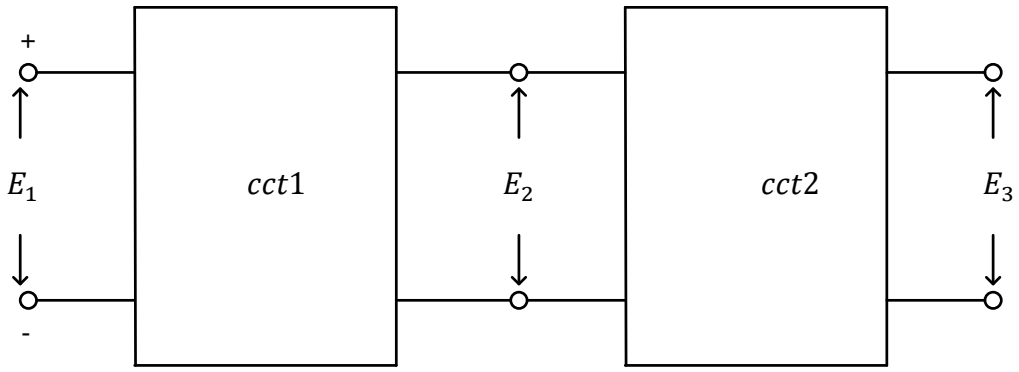
(30 markah/*marks*)

$$y_{cct1} = \begin{bmatrix} 0.2 & 0.02 \\ 0.02 & 0.5 \end{bmatrix}$$



Rajah 6(b)
Figure 6(b)

Rajah 6(b)(i)
Figure 6(b)(i)



Rajah 6(b)(ii)
Figure 6(b)(ii)

(b) Parameter-y di Rajah 6(b) disambung secara lata dengan litar di Rajah 6(b)(i). Keseluruhan sambungan kaskad ditunjukkan di Rajah 6(b)(ii). Dapatkan penyataan parameter T bagi keseluruhan sistem di Rajah 6(b)(ii). Tunjukkan kaedah dengan jelas.

The y-parameter shown in Figure 6(b) is cascaded with another circuit shown in Figure 6(b)(i). The overall cascade is shown in Figure 6(b)(ii). Obtain the T-parameter representation from the overall system shown in Figure 6(b)(ii). Show clearly the methods.

(70 markah/*marks*)

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